

READING

# Stocks and Flows

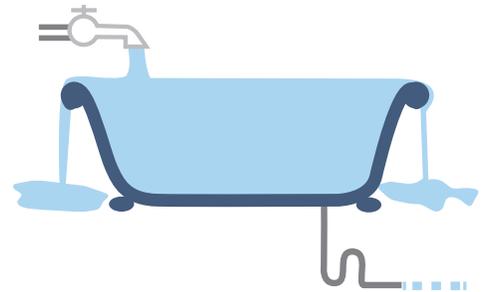
You may not be familiar with the term stocks and flows, but anyone who has taken a bath, opened a bank account, or contended with clutter at home intuitively understands stock-flow structures.

The amount of something you're studying—trees, fish, people, goods, clutter, information—is a stock. The rate at which a stock changes (increases or decreases) is its flow. In a bathtub the accumulation of water in the tub is the stock; the faucet controls the inflow into the stock, and the drain controls the outflow.

If you know how a bathtub works, you know about stocks and flows. Test your understanding with this simple quiz:

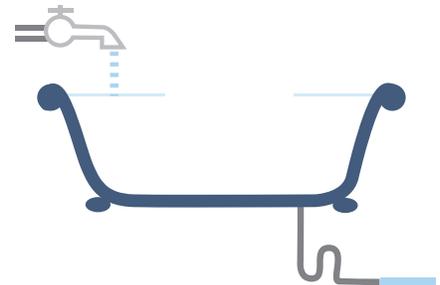
A. If the *inflow* is greater than the outflow

What happens to the level of the water in the tub?



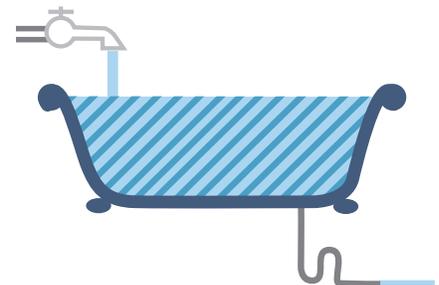
B. If the *outflow* is greater than the inflow

What happens to the level of the water in the tub?



C. If the *inflow* equals the outflow

What happens to the level of the water in the tub?



Answers:

- A. If water flows into the tub faster than it flows out, what happens to the amount of water in the tub? If you said the water level rises, you're right.
- B. If the water flows out of the tub faster than it flows in, what happens? Right again. The water level lowers.
- C. And if water level flows in at the same rate that it flows out? The water level will stay the same.

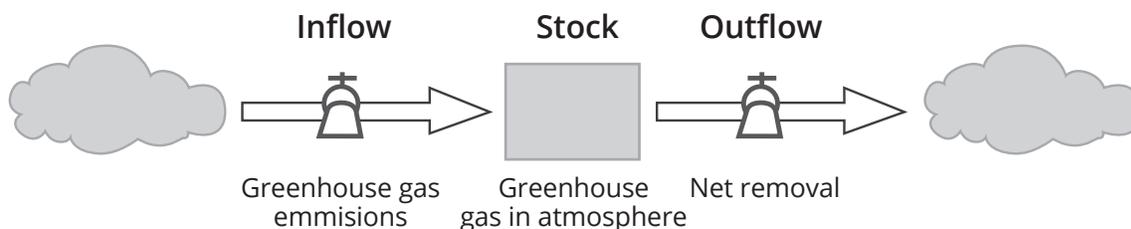
Systems scientists represent stock and flow structures using arrows and boxes like this:



	<p>The square represents the stock, or the accumulation, of something.</p>
	<p>Flows are represented by arrows or pipes that flows into or out of the stock.  The "T" on each flow represents a "valve." A flow can vary: it can be made slower or faster.</p>
	<p>The clouds represent where the flows come from and where they go.</p>

Bathtubs? Clutter? This may all sound so simple. Yet because stocks tend to accumulate, and we often don't **see** that accumulation, stock and flow processes are some of the most perplexing dynamics we encounter in the world. Studies of the pesticide DDT, for example, have shown that while DDT evaporates from the surface of plants and buildings over six months, it accumulates in the food chain of fish for up to 50 years. The amount of DDT in this food chain is a stock with very slow outflow.

The atmosphere accumulates carbon dioxide and other greenhouse gases the way a bathtub accumulates water. Carbon dioxide from burning fossil fuels or clear-cut trees is flowing into the stock (or atmosphere) twice as fast as it is normally being absorbed by carbon sinks (such as oceans, forests, or grasslands). And in addition, because of deforestation and chemical and temperature changes in the oceans, some of those carbon sinks do not hold as much carbon as they normally did, which means the "drain" is flowing even more slowly.



When we think in terms of stocks and flows, we understand that proposals to slow the rate of growth of carbon dioxide emissions will keep the inflow from increasing. But the stock (greenhouse gas in the atmosphere) will continue to grow until the inflow is reduced sufficiently that it equals or is smaller than the outflow.

Credit: Adapted from the original instruction set in *The Shape of Change* (Quaden, Ticotsky and Lyneis, 2008, Creative Learning Exchange). Permission granted for non-commercial educational use.

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